

# ACCESSING OCEAN TECHNOLOGY VALUE CHAINS

*A Guide for the Canadian Trade Commissioner Service*

April 2012

Lukas C. Brun, Joonkoo Lee, and Gary Gereffi



Duke

---

CENTER on  
GLOBALIZATION,  
GOVERNANCE &  
COMPETITIVENESS

This report was sponsored by the Canada Department of Foreign Affairs and International Trade (DFAIT) for the Trade Commissioner Service. We gratefully acknowledge Jane Rutherford for sponsoring the project.

Errors of fact or interpretation remain the exclusive responsibility of the authors. The opinions or comments expressed in this study are not endorsed by DFAIT or the Trade Commissioner Service. We welcome comments and suggestions. The corresponding author can be contacted at [lukas.brun@duke.edu](mailto:lukas.brun@duke.edu).

© April 2012      Center on Globalization, Governance & Competitiveness, Duke University

## SUMMARY

This guide is for trade commissioners working with Canadian small and medium-sized enterprises (SMEs) to access and upgrade capabilities in ocean technology global value chains. The guide provides a list of information to collect on ocean technology companies in Canada and abroad to increase the participation of Canada’s SMEs in ocean technology global value chains.

**TABLE 1: Overview of recommended activities**

Activity	What	Why	How	Who
<b>Identify capabilities of domestic firms</b>	<p>Identify the firm’s:</p> <ul style="list-style-type: none"> <li>entry point in the global value chain</li> <li>level of capability</li> <li>upgrading trajectory</li> </ul>	<p>Collecting this information:</p> <ul style="list-style-type: none"> <li>identifies the firm’s product or service category</li> <li>assesses the firm’s sophistication in its product or service offering</li> <li>identifies the firm’s path for capturing a greater share of the value in the product or service market</li> </ul>	<p>Conduct company research using:</p> <ul style="list-style-type: none"> <li>electronic resources and databases</li> <li>industry trade journals</li> <li>interviews with companies</li> </ul>	Trade commissioners stationed in Canada
<b>Collect information on foreign markets</b>	<p>In area of geographic responsibility, identify:</p> <ul style="list-style-type: none"> <li>leading producers and buyers</li> <li>the demand and use of ocean technology</li> <li>market and technology trends</li> <li>Information on standards and certification</li> <li>Lead firms’ supply chain management strategies</li> </ul> <p>Create value chain maps illustrating key actors at the geographic, company, and product level.</p>	<p>Collecting this information identifies:</p> <ul style="list-style-type: none"> <li>who to target</li> <li>what products are most relevant in the market</li> <li>level of technology development</li> <li>how access to the ocean technology value chain is controlled in the geographic area</li> </ul>	<p>Conduct interviews with:</p> <ul style="list-style-type: none"> <li>leading firms</li> <li>economic development authorities</li> <li>industry cluster organizations</li> <li>universities and research institutes</li> <li>professional societies</li> </ul> <p>A list of sample questions to ask during interviews is provided in Attachment A.</p> <p>A primer for value chain analysis is available <a href="#">here</a></p>	Trade commissioners stationed abroad
<b>Connect with business networks</b>	<p>Connect with research, business, and financial networks in area of geographic responsibility</p>	<p>Networks provide information about</p> <ul style="list-style-type: none"> <li>emerging market and technology trends</li> <li>commercialization opportunities</li> <li>financial resources</li> <li>skilled labor</li> </ul>	<p>Conduct interviews with:</p> <ul style="list-style-type: none"> <li>leading firms</li> <li>economic development authorities</li> <li>industry cluster organizations</li> <li>universities and research institutes</li> <li>professional societies</li> </ul>	Trade commissioners stationed in Canada and abroad

Activity	What	Why	How	Who
<b>Match foreign market needs with domestic capability</b>	Close identified market gaps in foreign market with capable domestic firms.	Provides market opportunities for Canadian firms.	Provide information to Canadian firms about the demand for products and services in the foreign market, including key contacts.  Provide to foreign firms information about Canadian SME products, services and capabilities across the value chain.	Trade commissioners stationed in Canada
<b>Transmit market and competitiveness information</b>	Act as a conduit of information for government actors in Canada about technology trends, commercialization opportunities, and public policies affecting the competitiveness of the ocean technology sector abroad.	Identifies innovative policies, emerging technology and market trends, which can be used to increase the competitiveness of the Canadian ocean technology sector.	Provide information to Canadian national, provincial, and local governments about innovative policies supporting the ocean technology sector abroad. These include commercialization assistance, eminent scholars programs, and tax and subsidy policies targeted on the ocean technology sector, or high technology sectors generally.  Provide information to universities, oceanographic institutions, and public-private partnerships (Centers of Excellence) about emerging technology trends and commercialization opportunities in foreign markets.	Trade commissioners stationed abroad

Source: Duke CGGC

## RECOMMENDED ACTIVITIES

### 1. *Identify capabilities of domestic firms*

*Key question:* What is the firm’s entry point, level of capability, and upgrading trajectory in the global value chain?

- The entry point of a firm in the global value chain identifies the firm’s product or service category.
- The level of capability assesses the firm’s sophistication in its product or service offering.
- The upgrading trajectory identifies the firm’s path for capturing a greater share of the value of a product or service.

**Entry point:** Knowing the company’s products, services, and end-markets identifies the SME’s market niche. Understanding the company’s line of business is a necessary first step for all other activities recommended by this guide. Industry classification systems (NAICS, SIC, DUNS) are useful for identifying in what industry the firm is located. SMEs in ocean technology value chains tend to fall into two major categories: product

component manufacturers, and service providers to lead firms. Product component manufacturers develop software or hardware products for use in larger systems. Service providers in the ocean technology sector can range from support services for product manufacturers to consulting services for end-users.

**Level of capability:** A firm’s capability in pre-production, production, and post-production activities can range from low to high. Identifying the level of sophistication in each of these activities assists in identifying potential trade partners abroad and upgrading trajectories for the firm. A table useful for assessing the capability of firms is provided below.

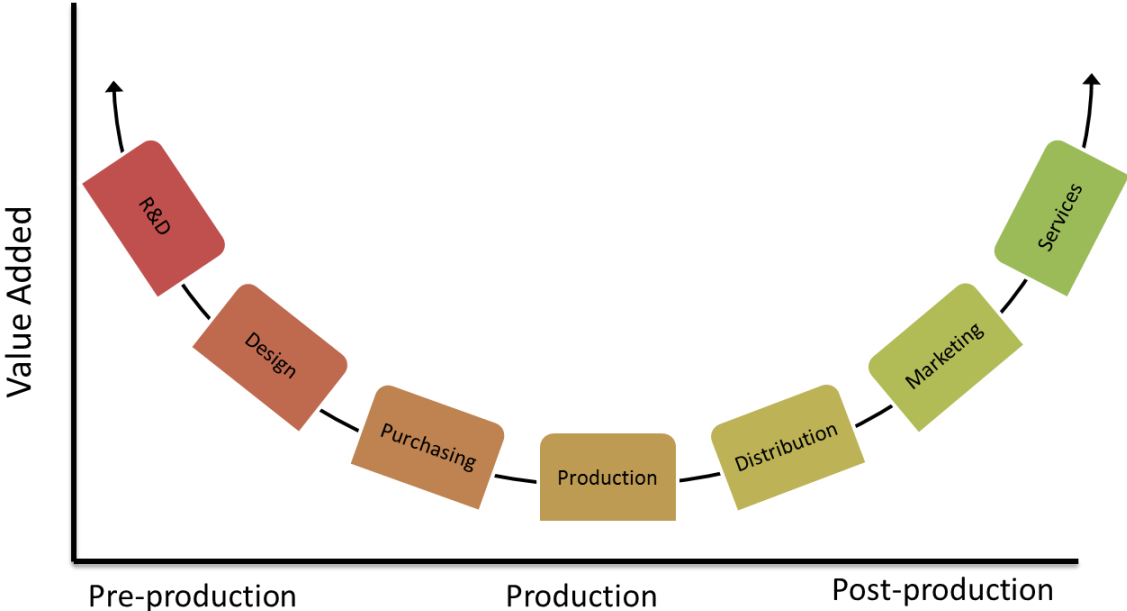
**TABLE 2: Firm capability, by value chain stage and segment**

Stage	Value Chain Segment	Capability Level	Activity	Example
Pre-production	Research & Design	Low	Product design modification and customization	Re-designing ships for conversion and refitting
		Medium	Applied research and new product design	Developing a new hull design for icebreakers with advanced icebreaking capability; developing paint to minimize hull friction
		High	Basic ocean technology research	Conducting scientific research to reduce hull friction caused by the ice
	Purchasing	Low	Local search for supply chain partners	OT platform manufacturer identifies metal finishing contractors within 20 km of plant
		Medium	Local and regional search for supply chain partners + practice of simple supply chain management practices	OT platform manufacturer scans for regional metal finishing service providers and maintains informal quality assessments of suppliers
		High	Regional and/or global search for supply chain partners + sophisticated supply chain management practices	OT platform manufacturer seeks “best in class” component producers and evaluates suppliers with balanced scorecards
Production	Production	Low	Simple component manufacture	Producing components for mature ocean sensors, such as pH sensors.
		Medium	Simple component manufacture + assembly	Assembly of commercial off-the-shelf technology into a new product, or production of moderately sophisticated components, such as remotely-operated vehicle (ROV) winches.
		High	Fully integrated manufacture + assembly; high-tech component production	Producing sophisticated navigation systems for ROVs, such as dynamic positioning systems.
Post-production	Marketing, distribution and post-production services	Low	Domestic distribution	Domestic distribution and repair network for hand-held sonars.
		Medium	Domestic + international distribution and marketing activities	Operating international distribution networks of a wide-range of ocean technology products, from marine sensors to ROVs.
		High	Domestic + international distribution and marketing activities + advanced post-production services, such as consulting & training	Providing post-production services for ROV/AUV, such as leasing and operating, consulting and training, in addition to the distribution and sales of ROV/AUV

Source: Duke CGGC

**Upgrading trajectory:** Upgrading refers to the movement of a company’s activities to capture a greater share of the value in a product or service. In most sectors, the value-added at each segment of the value chain varies. In high technology sectors, product manufacturing contributes a lower percentage to the product’s final value than pre-production activities, such as R&D and design, or post-production activities, such as marketing and services.<sup>1</sup> This “smile curve” is found in many other high technology sectors, including ocean technology.

**FIGURE 1: Value added in the ocean technology value chain**



Source: adapted from Dedrick, Kraemer & Tsai, 1999

Upgrading expands the activity of the firm to portions of the value chain that capture a greater share of the total value of a product or service, thus increasing the competitiveness of the firm.

**TABLE 3: Upgrading in the ocean technology sector**

	Value Chain Segments	Description	Example
Entry into the value chain	<div style="display: flex; gap: 10px;"> <div style="background-color: #c8a27d; padding: 5px;">Production</div> <div style="background-color: #92d050; padding: 5px;">Services</div> </div>	<ul style="list-style-type: none"> <li>Firm offers ocean technology products or services.</li> <li>Focus of the company may be relatively narrow to focus on a specific customer, product, service or end-market.</li> </ul>	<ul style="list-style-type: none"> <li>Company produces tethers for ROVs.</li> <li>Company provides mapping services for an oil and gas company.</li> </ul>

	Value Chain Segments	Description	Example
Developing better products or services (Product Upgrading)		<ul style="list-style-type: none"> <li>• Company offers better, higher quality products and/or services.</li> <li>• Focus of the company is to increase unit value of products or services offered.</li> </ul>	<ul style="list-style-type: none"> <li>• Company produces more durable or better designed products.</li> <li>• Company offers services requiring advanced engineering capabilities.</li> </ul>
Expansion across value chain segments (Functional Upgrading)		<ul style="list-style-type: none"> <li>• Firm adds services to existing product manufacturing or adds product manufacturing to services.</li> <li>• Focus of the company expands to an increasing number of value chain segments, products, or services.</li> <li>• Company may carry out pre-production processes, such as design or product development with a major customer or research partner.</li> </ul>	<ul style="list-style-type: none"> <li>• Service provider to oil and gas companies builds its own ROV.</li> <li>• ROV manufacturer adds refurbishment and pilot training services to product offerings.</li> </ul>
Increasing productivity (Process Upgrading)		<ul style="list-style-type: none"> <li>• Company focuses on increasing the productivity of value chain segments.</li> <li>• Reconfigures production processes, pre- and post-production activities to become more efficient.</li> <li>• Out-sourcing and in-sourcing are considered as options for increasing productivity.</li> </ul>	<ul style="list-style-type: none"> <li>• Company reconfigures production line to be more efficient.</li> <li>• Company streamlines distribution network to focus on getting products to market faster.</li> <li>• Company outsources product design to specialized firm, or chooses to purchase vital component product supplier.</li> </ul>
Selling across end-markets (Inter-sectoral Upgrading)		<ul style="list-style-type: none"> <li>• Company finds new product markets for existing products, or modifies existing products for customers in new end-markets.</li> </ul>	<ul style="list-style-type: none"> <li>• Company modifies navigation system for unmanned underwater vehicles for unmanned aerial vehicles.</li> <li>• Firm experienced in advanced manufacturing technology, such as MEMS (Micro-Electro-Mechanical Systems) or nanotechnology, applies it to new product.</li> <li>• Piezoelectric ceramic manufacturer for military-grade sonars develops applications for medical instruments.</li> </ul>

Source: Duke CGGC

## **2. Collect information on the foreign market**

*Key question:* What is the demand for and supply of ocean technology in the region, and who are the key economic actors?

Trade commissioners should collect industry information on ocean technology in their geographic area of responsibility. Specifically, this includes identifying:

- the demand and use of ocean technology
- the producers and buyers of ocean technology in the region, especially lead firms
- market and technology trends
- lead firms' supply chain management strategies. Seek to understand how lead firms select supply chain partners and the requirements they impose on suppliers
- information on standards and certification. This information is critical because meeting standards and certifications are often a key determinant for a firm in selecting supply chain partners.

Collecting this information identifies:

- who to target
- what products are most relevant in the market
- level of technology development
- how access to the ocean technology value chain is controlled in the geographic area.

To collect this information conduct interviews with:

- leading firms (sales and marketing managers are particularly well-informed and willing to speak about their company)
- economic development authorities
- industry cluster organizations
- universities and professional societies

A list of sample questions to ask during interviews is provided in Attachment A. To organize and communicate the information, use value chain mapping at the market, company and product level. A primer for value chain analysis is available [here](#).

## **3. Connect with research, business, and financial networks**

*Key question:* What are the emerging market and technology trends, commercialization opportunities, and available financial and human resources in the market?

SMEs are limited in their ability to access formal and informal networks that transmit information to participants about emerging market and technology trends, commercialization opportunities, and available financial and human resources. Trade commissioners can help overcome the limited ability of SMEs to



access formal and informal networks that provide many of the business opportunities in the ocean technology sector. Trade commissioners, stationed in Canada and abroad, should participate in:

- research networks centered on major universities and oceanographic institutes
- industry cluster organizations and public-private partnerships (Centers of Excellence) commercializing new products
- financial networks that transmit information about private and public sources of funds, including venture capital, angel investors, and government commercialization programs.

These networks also provide information about available human capital, which is useful for SMEs interested in recruiting and retaining a highly skilled workforce of scientists, engineers, and technologists capable of developing, commercializing, and producing high technology products.

#### ***4. Match needs in foreign market with domestic capability***

*Key question:* What are the existing gaps and emerging opportunities in ocean technology for Canadian firms in the foreign market?

The purpose of the preceding steps is to understand the existing capabilities of domestic firms and to identify gaps and emerging opportunities in the foreign market. The next step is to match companies with Canadian companies with existing capabilities, or companies willing to upgrade, to close the identified need in the foreign market. Trade commissioners should provide information to Canadian firms about the demand for products and services in the foreign market, including key contacts. But trade and information is not a one-directional process, particularly in an industry with high levels of inter-sectoral trade like ocean technology. Trade commissioners stationed abroad should also provide to foreign firms information about Canadian SME products, services and capabilities across the value chain.

#### ***5. Transmit market and competitiveness information***

*Key question:* How can the information gathered abroad be used to increase the competitiveness of the Canadian ocean technology sector?

Incidental to their daily activity, trade commissioners stationed abroad gather information on market trends, technology trends, and policies foreign governments use to develop their ocean technology sector. National, provincial, and local government actors in Canada can use this information to increase the competitiveness of the ocean technology sector at home. Trade commissioners should provide information to Canadian national, provincial, and local governments on commercialization assistance, eminent scholars programs, and tax and subsidy policies targeted on the ocean technology sector, or high technology sectors generally. Trade commissioners can also act as conduits of information to oceanographic institutions, universities, and public-private partnerships (Centers of Excellence) about emerging technology trends and commercialization opportunities in foreign markets.

## Attachment A

### Interview questions (companies)

- Please give me a thumbnail sketch of your firm [history, size (sales/employment), growth]
- What are your core technologies, products and/or services? What end markets do you serve?
- What competitive trends are you observing in the industry?
  - outsourcing/off-shoring
  - price/quality pressures
  - demand for new products, technology or services
- Who are your major competitors? Where are they located?
- What components do you import? How do you find your supply chain partners? Where are they located? [For interviews abroad: Do you have suggestions for how to increase the participation of Canadian firms in your supply chain?]
- What standards or certifications are important to your business?
- Where are your major export markets? With whom do you work with internationally? [For interviews abroad: Who in North America and other countries are your most important business partners? ]
- What is the business environment in [location]? What do you like? What would you change?
  - taxes?
  - labor availability and skills?
  - business support from national, provincial & local agencies (Who is your contact in these agencies? what do they do? what would you like to see more/less of?)
  - trade (do trade policies affect your business? how?)

### Interview questions (industry cluster organizations, trade associations, economic development authorities)

- When talking to your member-companies, what market opportunities and threats do you hear about the most?
- Who are the leading companies in ocean technology in your region? What end-markets do they serve?
- What competitive trends are you observing in the industry?
  - outsourcing/off-shoring
  - price/quality pressures
  - demand for new products, technology or services
- Where is the competition for your member-companies located?
- What is the business environment in [location]? What do your member-companies like? What do they complain about?
  - taxes; labor availability and skills
  - business support from national, provincial, local government agencies (what do they do? what would you like to see more of?)
  - trade (do trade policies affect the business of your member companies?)
- Do you have contacts with any of the leading companies with whom I could speak?

**Interview questions (universities, private-public partnerships [Centers of Excellence] and oceanographic research institutes)**

- Please give me a thumbnail sketch of your activities and areas of research
- What market and technology trends are you observing?
- Do you, your university, or your researchers have contact with universities, research centers, or researchers in Canada? Can you share any contact information with me?
- How do researchers with product ideas commercialize their products? Do government agencies in [location] provide commercialization support?

---

<sup>i</sup> Dedrick, Jason; Kraemer, Kenneth L.; & Tsai, Tony. (1999). Acer: An I.T. Company Learning to Use Information Technology to Compete. UC Irvine: Center for Research on Information Technology and Organizations. Retrieved from: <http://escholarship.org/uc/item/9j8146rq>